Interaction Assessment (INTASS): An Ecological Modeling Tool to Infer Population Dynamics

Interaction assessment (INTASS) is a field and analytic methodology that uses emergent patterns of dispersion to parameterize population dynamics models. The dependent variable of the model is fitness (per capita rate of population change), which is written as a function of predators, competitors, availability of resources (e.g., food & shelter), and physical habitat characteristics. These independent variables often are collected from multiple spatial scales. While collecting data on one focal species, additional data on other community members can be obtained with little additional effort. Applicable to a wide array of taxa, the method can address key management and conservation issues, such as threats posed by invasive species, wildlife management, and conservation of imperiled species.

Biologists sample a habitat unit in northern California for juvenile salmonids and amphibians.

Background

Modern ecology has been progressing towards developing predictive tools. Because of the complexity inherent in even the most simple ecosystem, this challenge has proven difficult. Now, technological advances in computing and data collection are allowing ecologists to describe the dynamic nature of ecosystems with sophisticated modeling techniques.

What is INTASS?

INTASS is a model platform, portable across a wide range of taxa and habitats that is used to construct population dynamics models. These models describe the way in which physical and biotic characteristics of a species' environment determines the average individuals ability to grow and reproduce. INTASS rests on the assertion that density dependent feedback creates dispersion patterns where the expected fitness of individuals tends towards equality over different occupied microhabitats. Managers can utilize INTASS to characterize and predict the biological consequences of natural and anthropogenic stressors on managed species and their environments.

What does INTASS do?

INTASS uses field data to define a general mathematical expression describing how species interactions and the physical environment affect a population's growth and persistence. The magnitude and sign of terms representing independent variables (e.g., habitat characteristics, food, predators) in the mathematical expression determine the relative strength and direction of the effect that a particular term has on the fitness for a species of interest.

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A Pacific Giant Salamander (*Dicamptodon tenebrosus*) patrols pool habitat in the headwater stream of the south Fork Trinity River. Northern California.

Management Potential

Develop understanding about the magnitude and direction of change in managed populations related to:

- Invasive species
- Threatened and endangered species

- Habitat and ecosystem conditions
- Environmental contaminants
- Wildlife management
- Global change

Publications

Emlen et al. (2003) outlines the theoretical underpinnings of the INTASS approach, provides a rigorous mathematical framework, and demonstrates its use and breadth with applications to a large mammal and an invasive grass.

Emlen, J.M., D.C. Freeman, M.D. Kirchhoff, C.L. Alados, J. Escos, and J.J. Duda. 2003. Fitting population models from field data. *Ecological Modeling* 162:119-143.

Model Application in Geographic Focus Areas

- *Pacific Northwest-* Determination of habitat associations and competition between juvenile steelhead, Pacific giant salamanders and other stream dwelling animals in the Klamath-Siskiyou ecoregion
- *Great Basin-*Characterization of the effects of different grazing regimes of cold-desert plant communities in Utah subjected to a long-term grazing experiment. Also, determination of environmental factors most responsible for cheat grass and halogeton invasions
- *Rocky Mountains-* Characterization of the effects of different grazing management strategies on riparian plant communities in Wyoming
- *Alaska-* Growth rates of island populations of Sitka black-tail deer
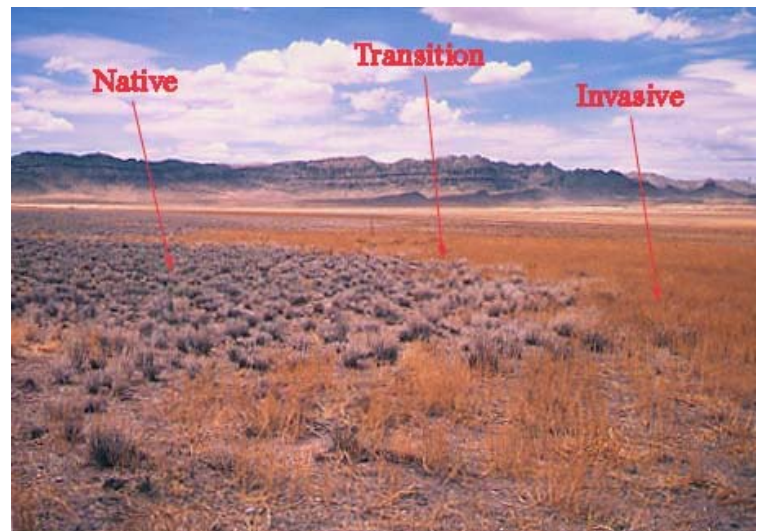
Halogeton glomeratus invades a low diversity desert community dominated by winterfat. We measured dispersion patterns of native and exotic plants, soil and tissue chemistry and bacterial functional diversity of soils derived from the native community, the invading exotic community, and the narrow transition zone between them (Duda et al., 2003).

For additional information, please contact:

John Emlen, Ecologist
Lyman Thorsteinson, Center Director
U.S. Geological Survey
Western Fisheries Research Center
6505 NE 65th Street, Seattle, WA 98115
(206-526-6282 FAX (206) 526-6654
http://wfrc.usgs.gov